

The broad scope for Agriculture Renewable Energy



A. Oil Platform

From where will we satisfy our energy demand?

Everywhere.



B. Dairy Farm

Dairy Producers of New Mexico



170 Family Farms

Kyle Hoodenpyle
Ag2Energy
Roswell, NM



Dairy Products



The Earth

An Advanced Civilization



Fire up the

**Fusion
Energy
Drive**

When the Aliens first visited Roswell...they saw an advanced civilization..

we were building space ships and powering the nation

Luckily they
CRASHED

But the Aliens still dreamed of attacking Earth.

- We can judge our opponents by their

Energy Source.



Aliens Laughing...Attack



To survive man must consume:

It is a necessary aspect of life.

Water



Air



Food



Energy



To live within the standard of living we have come to expect we must consume a lot...

It is the nature of man to live as well as he can... provide the best he can for his family.



*In our efforts to
procure these
necessities,*

*man has adversely
impacted our only
source of supply...*

The Earth



**Certainly man does not need to apologize for
consuming that which is required for living,
we simply need to live...**

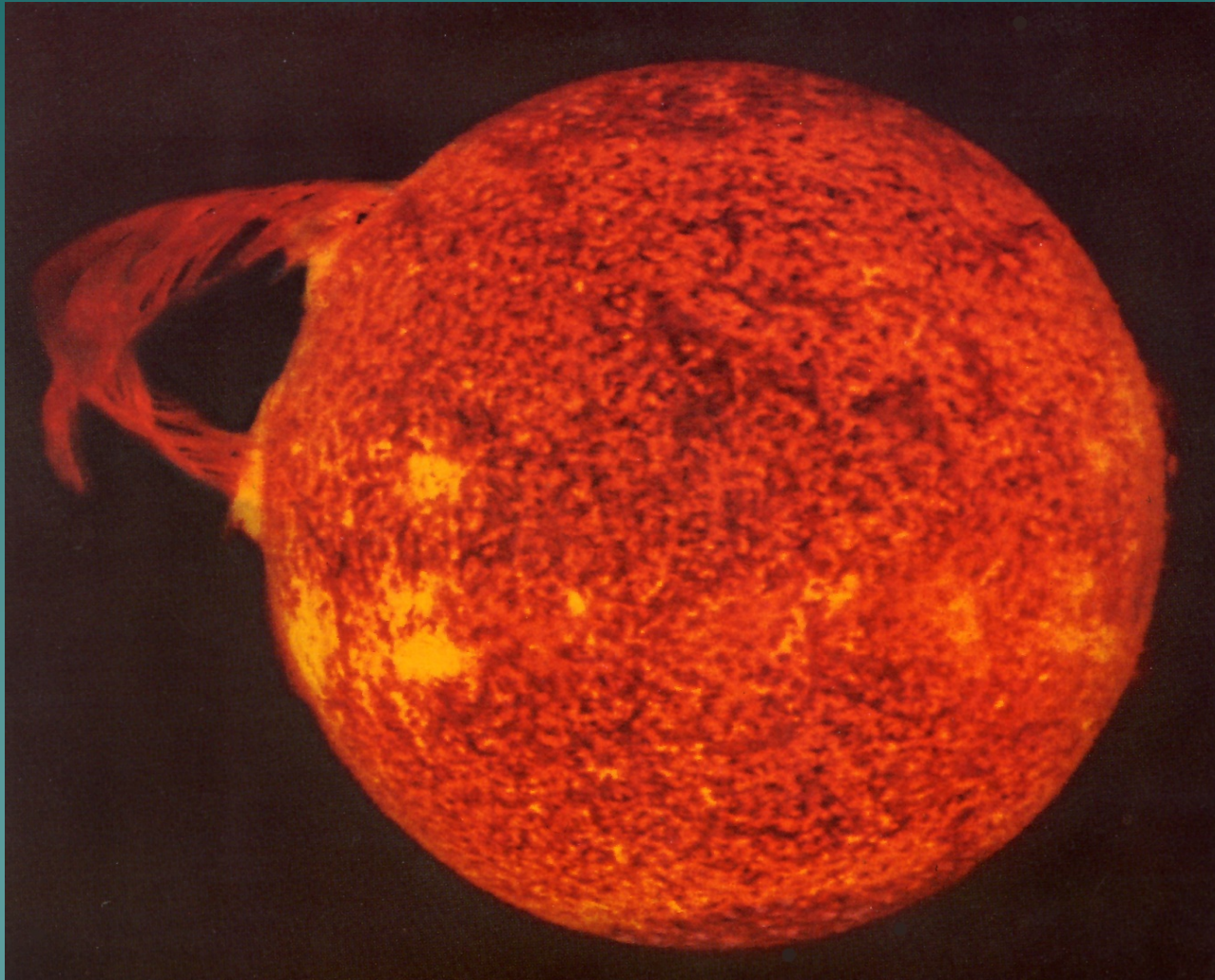
Sustainability

*We can effect change to minimize or reverse
our impacts on the earth
and insure a better place to live.*

The first step... is simply to care.

A stylized, dark teal silhouette of a mountain range is positioned in the bottom right corner of the slide, partially overlapping the text area.

There is no shortage of Energy.. Just our access to it.



- Immediate Sunlight
Heat, PV, Wind

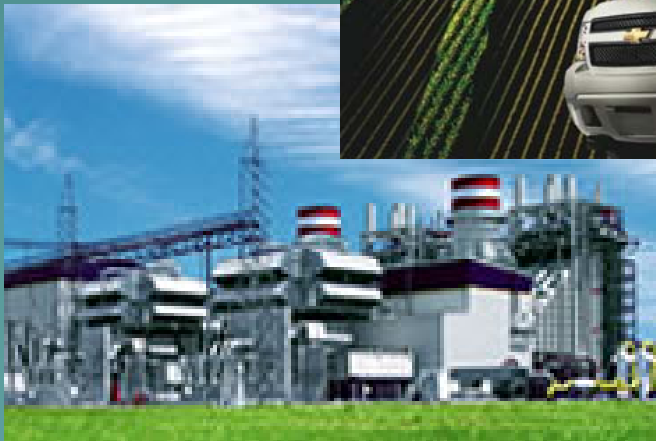
- Stored Sunlight
Coal, Petroleum, NG,
Oil shale and sands

- Hydrogen??
It is on the Sun.

- **Biomass- Stored
Energy**

Mans primary utilization of energy is still very primitive...burning something!

- ◆ The Majority of our energy is from the combustion of hydrocarbons



Crops and Feed

PROCESSING



ALFALFA



The U.S. possesses a large and diverse network of agri-industrial facilities which consolidate and process large quantities of agriculture materials into their value-added products.

Grains



SILAGE



These agri-industrial facilities typically consume large amounts of energy, water and have significant waste streams.



The Pecos Valley Biomass Cooperative is constructing an integrated system and processes to utilize waste streams from dairy and other associated agri-industries for production of energy, biofuel, and other co-products.

How do we go...

From Here!



High Value Natural Gas



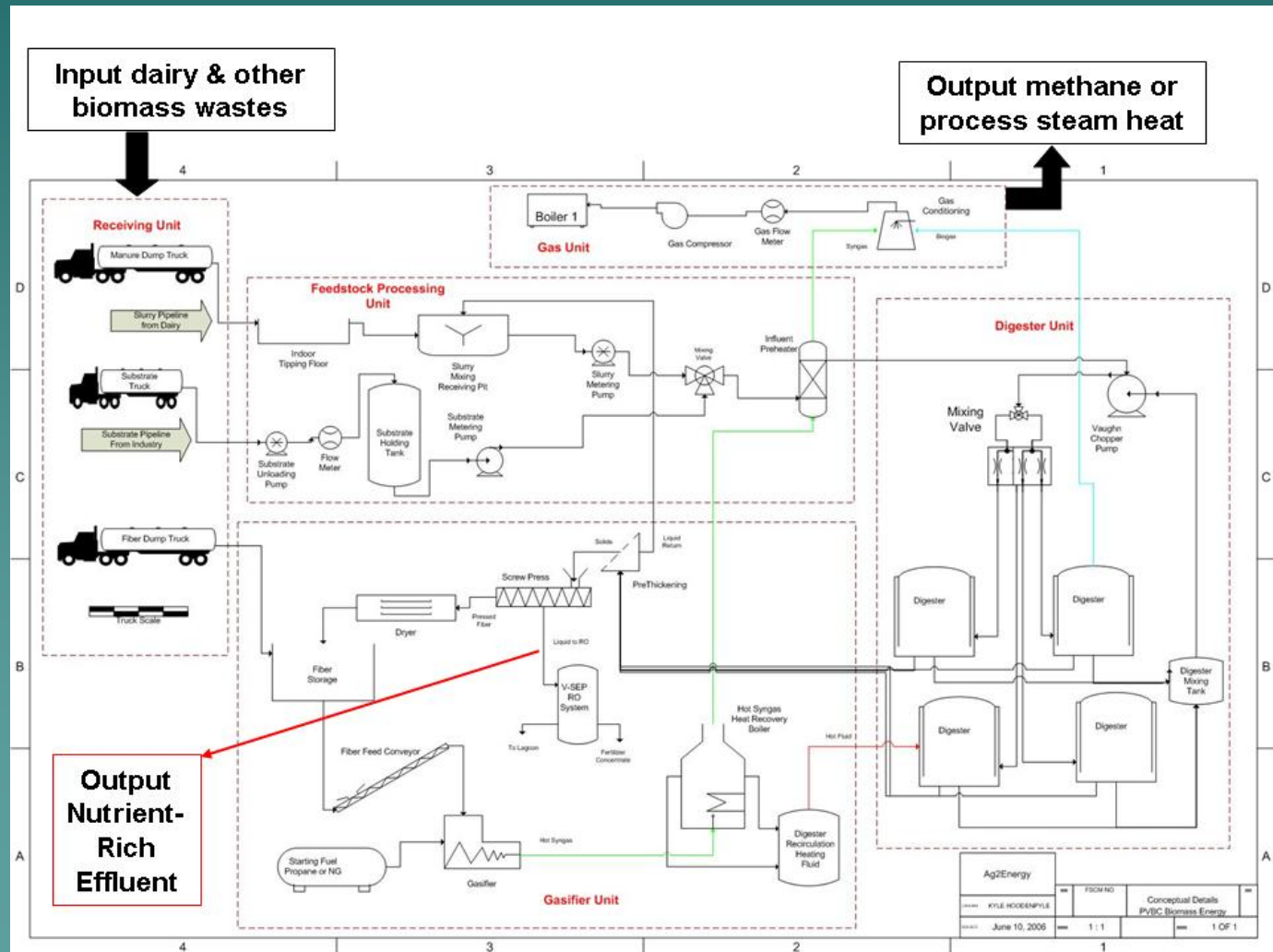
High Value Crop
Fertilizer

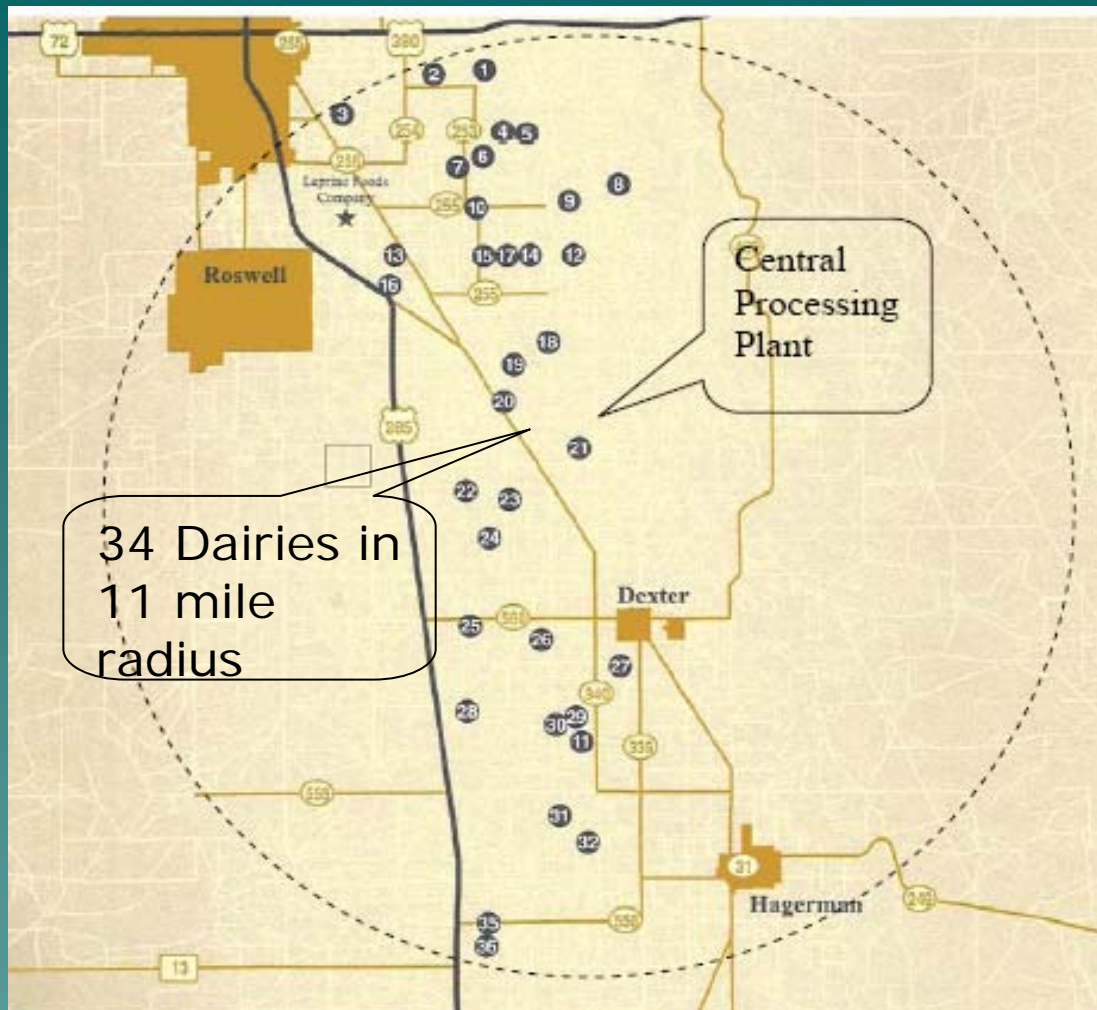


TO HERE!



The integrated “biorefinery” center concept brings together systems and processes that include a complementary mix of anaerobic digestion and gasification for production of bio-methane, process steam coupled with the system enhancement of implementing algae-based production of biofuels and coproducts using nutrient-rich *effluent*.





The trend in dairies across the US is exemplified by our example in New Mexico

There are fewer and larger dairies concentrated around a Local Dairy Infrastructure (LDI).

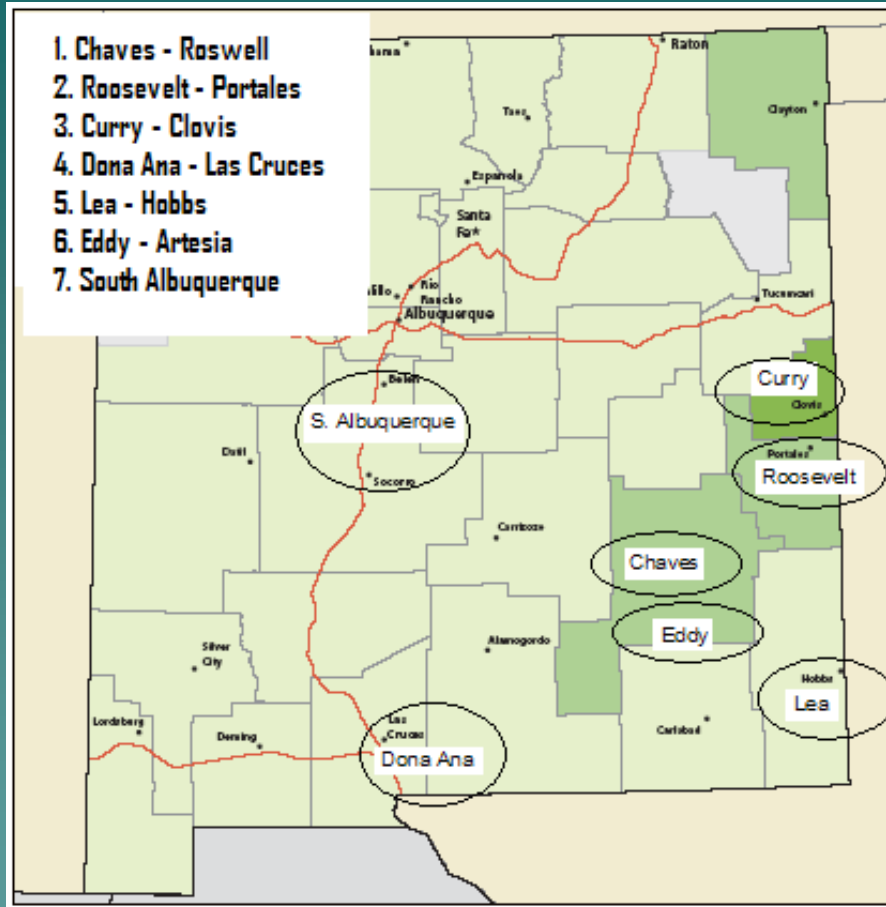
Present economies of scale have dictated this move in dairy production.

The LDI consists of many large dairies supplying product to large milk and cheese processing plants centered around a transportation and feed infrastructure.

For example, in New Mexico we have the largest average herd size dairies in the US (>2000 head) and several of the largest cheese plants in the world. (Leprino and Southwest Cheese)

Pecos Valley Biomass Cooperative

NM Dairy & other Biomass



Dairy “Anchor” feedstock supply

Dairy Biomass can act as an “anchor” feedstock supply

...for a state-wide biorefinery system which can in turn utilize the state’s other variable and seasonal Biomass supplies

...which in themselves would not warrant a scale for commercial use.

Variable & Seasonal Feedstocks

- Crop Residues
- MSW
- Salt Cedar & Juniper

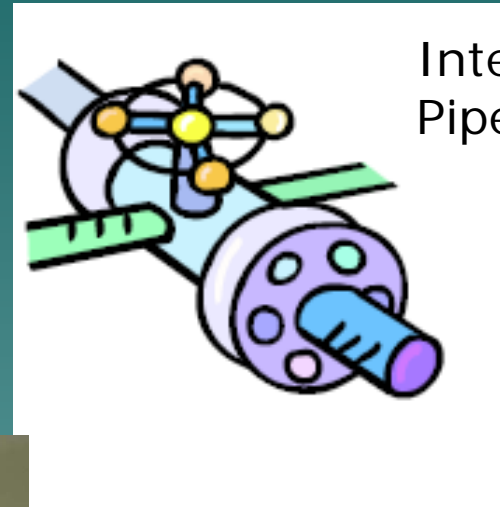
Total NM Dairy Biomass Produced

Region	County City	Dairies	Milk cows	Milk Cows Tons/day DM	Heifers	Heifers Tons/day DM	Total/day (tons DM)	Total/year (tons DM)
1	Chaves Roswell	39	85,317	640	69,960	262	902	329,313
2	Roosevelt Portales	44	57,300	430	46,986	176	606	221,171
3	Curry Clovis	20	53,068	398	43,515	163	561	204,835
4	Dona Ana Las Cruces	24	47,426	356	38,889	146	502	183,058
5	Lea Hobbs	16	25,276	190	20,726	78	267	97,562
6	Eddy Artesia	7	16,138	121	13,233	50	171	62,290
7	South Albuquerque	16	12,574	94	10,310	39	133	48,533
	Total	166	297,099	2,228	243,619	914	3,142	1,146,762

1. Ensure Dairy Industry Sustainability



2. Capture all energy and nutrients in animal manure



Interstate
Pipeline



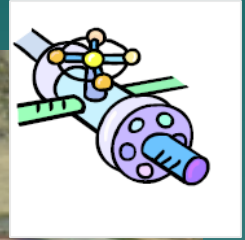
3. Produce a high value Renewable Natural Gas

4. Produce a high value NPK fertilizer

What will we
accomplish?

2. Capture all energy and nutrients in animal manure

GAS



FERTILIZER



Goal

Ag2Energy Anaerobic Digestion system (Ag2E ADS)

The Ag2E ADS is a lagoon based; synthetic lined, heated, insulated, center-pivot constant mixed, high solid loading, spiral plug flow system.

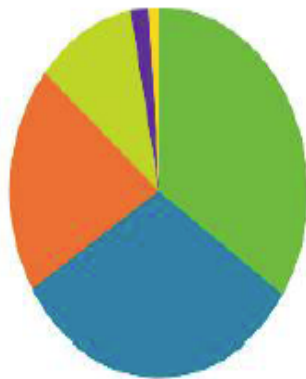


Utilize advanced
materials for
construction

3. Produce a high value Renewable Natural Gas

- ◆ PG&E: Pacific Gas & Electric, California

California-Eligible Renewable Resources



California-Eligible Hydroelectric	- 35%
Biomass	- 32%
Geothermal	- 20%
Wind	- 11%
Biogas	- 2%
Solar	- less than 1%

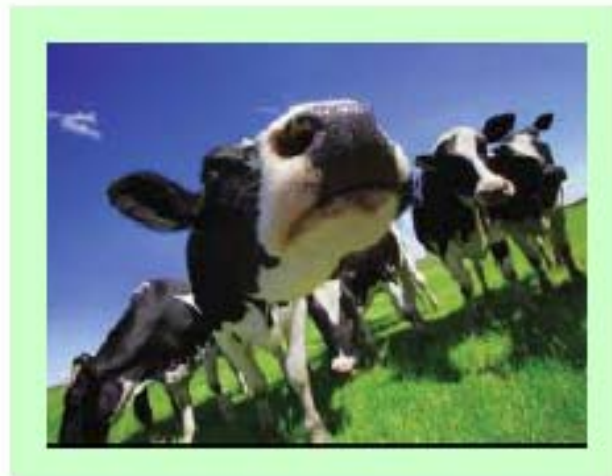


Who will
buy our
gas?

Cow Power

- New, innovative way PG&E is realizing its renewable energy goals
- Bio-methane from dairy manure will be sent through California's natural gas pipelines
- Provides renewable energy and prevents methane from escaping to the atmosphere
- Avoids local air impacts in California's Central Valley

BioGas



California has significant resources for bio-methane generation and capture

PG&E has announced gas purchase agreements with BioEnergy Solutions and Microgy for the purchase of pipeline-quality biogas from dairy waste.

Advantages of Pipeline Biogas

- Provides reliable renewable gas supply
- Most efficient use of biogas for generating electric energy
- Significant reduction of greenhouse gas emissions at dairy
- Utilizes existing transmission pipeline infrastructure
- Provides dairy with new revenue source
- Improves air quality by removing a combustion source



4. Produce a high value NPK fertilizer



Granulation
Equipment

Growing food
requires fertilizer

12-8-8-4 : 2% Iron















Results of Collection and Pre-Processing System



Clean
Corrals

Clean
Alleys



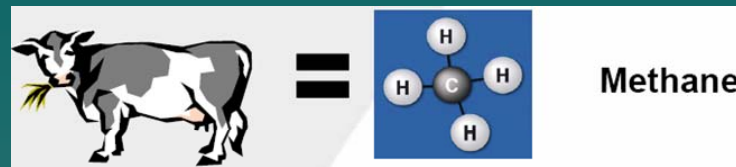
Fresh Manure	Dried Manure
Volume = 100 m ³	Volume = 30 m ³
 	
 	
 	  
  	
# of truckloads = 8.3	# of truckloads = 2.5

Decreased air
emissions

Decreased water
nitrate problems

Less overall Truck
Traffic

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**Pecos Valley
Biomass Cooperative**

**Dairy Producers of
New Mexico**



Ag2Energy
Commercial Algaculture System
(ACAS)
(Commercial Farming of Algae)
Patent Pending

Ag2Energy LP
Kyle Hoodenpyle

A stylized silhouette of a mountain range in a darker shade of teal, located in the bottom right corner of the slide.



Imagine Algae cultivation farms

This 12 square mile satellite image could be a depiction of future Commercial Algaculture, the Commercial Farming of Algae. In fact the image is of farms in Kansas (2); the circles are grain crops farmed under center-pivot irrigation systems. The large circles are one mile in diameter; small circles are 1/2 mile in diameter.

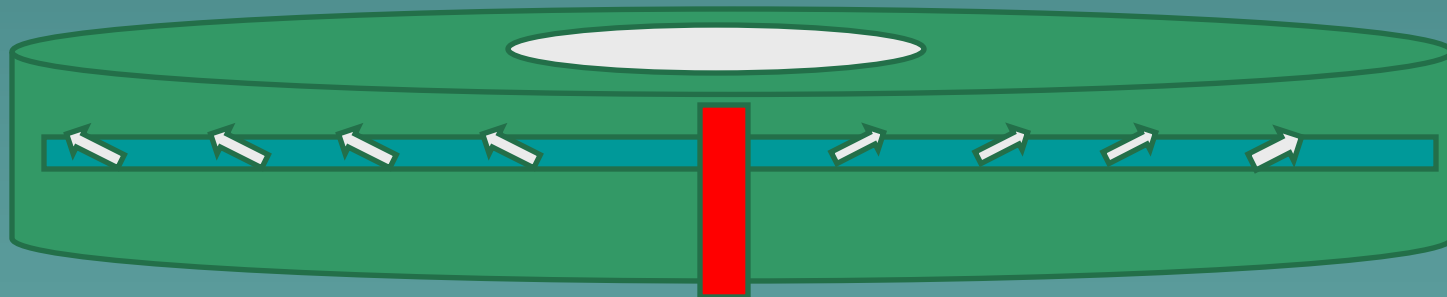
Imagine covered algae ponds next to our power plants!



Algae can sequester green house gasses like CO₂ and NO_x from power plants while creating fuels and valuable byproducts

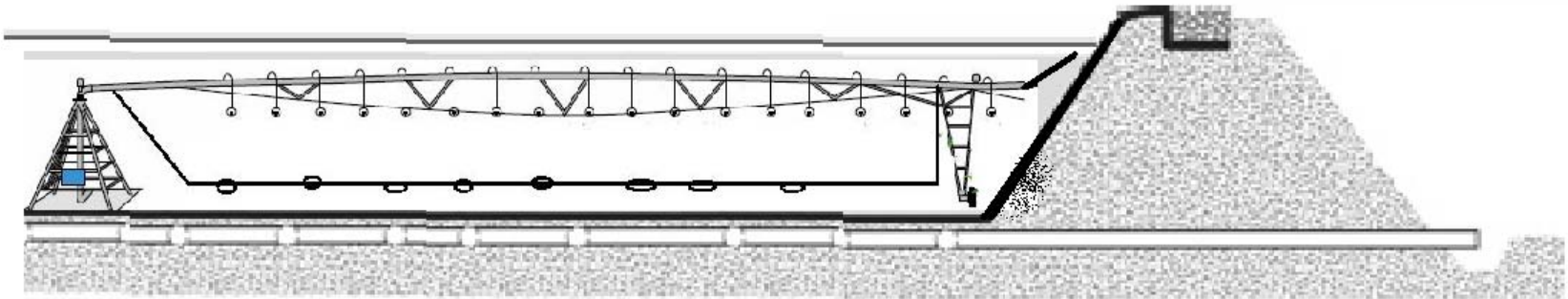
Integrated Algae Pond system

- Center Pivot Distribution & Harvesting System
- Jet ejectors along lateral
 - Mix
 - Propulsion
 - Harvest by driving algae to inside or outside
 - Gas Passage in cover assists movement
 - Dead zone and sumps in center collects algae

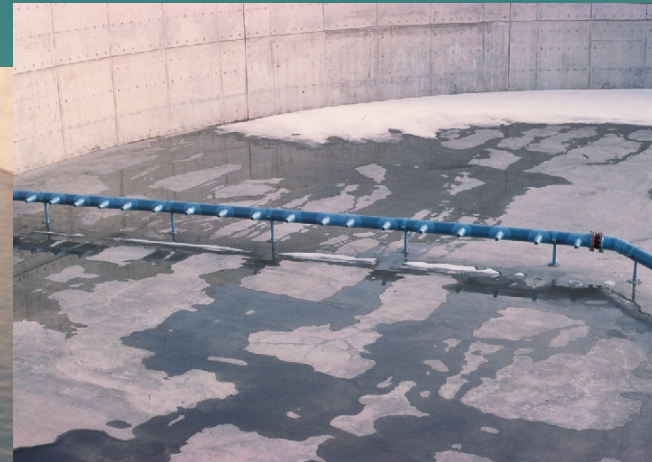
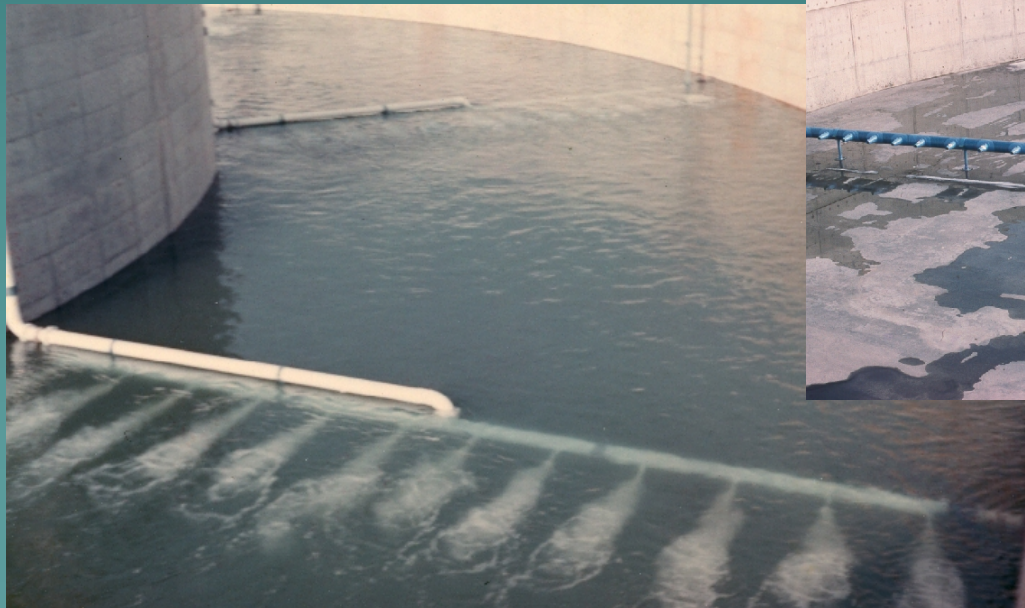


The Concept

Mixing, nutrient distribution,
harvesting, etc with a
submerged
Center Pivot Arm



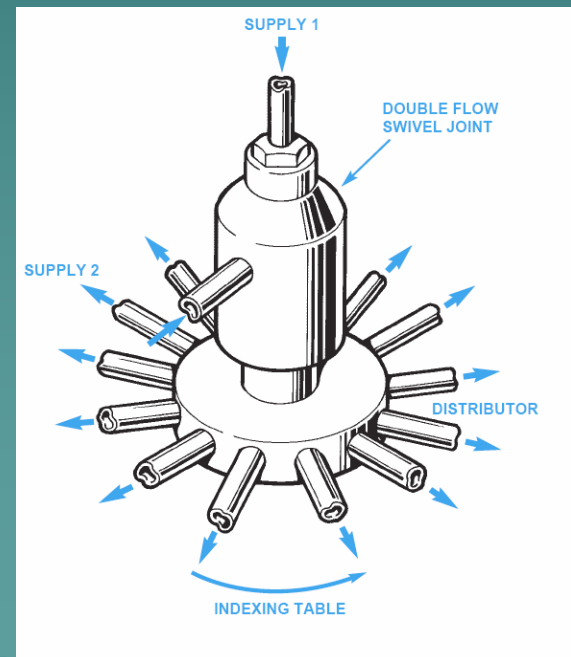
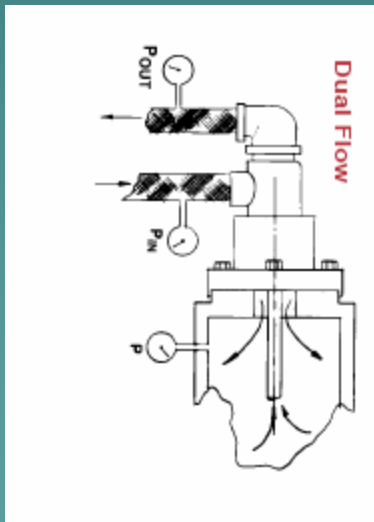
Jet ejector nozzles on a
two lateral/pipe system
mix and propel center
pivot arm



Rotary Union (RU)

Rotary Union or Swivel Joints are sealing devices which function as rotary interfaces for multiple fluids and/or gasses allowing the leak proof transfer of the fluid/gas to and from slow and intermittent rotating machinery.

The Rotary Union utilized for the center pivot distribution in the algae pond will consist of a dual rotary union. One fluid conduit will carry re-circulated water. The second will carry CO₂ gas.



4

3

2

1

D

D

C

C

B

B

A

A

Synthetic lined lagoon min 40 mil
2:1 side slope
1% grade on floor to center
2 ft freeboard
Liner secured in 1 ft trench
Top weights and drainage
Top gas collection passages

Nozzles/Jet Mixers:
Mixing involves
recirculation of CO₂ from
the gas space or from the
gas holder to calibrated
eductor nozzles fixed on
the arm

Transparent Cover:
Imbedded channels

Perimeter gas
collection tube circles
pond under cover

**Center Pivot Implement
Arm:** Single or multiple
lateral pipe/s with calibrated
nozzles or eductors
distribute gas, propel unit
and move sludge to center

Center pivot rotary joint
(rotary union)

Liner: Sludge flow to
central collector and
pumped out

Collection
Sump

CO₂
Blower

Filter

Re-Circulation
Pump

Filter

Ag2Energy

DRAWN KYLE HOODENPYLE

ISSUED March 8, 2008

SIZE

NA

FSCM NO

DWG NO

Center-Pivot Algae Pond

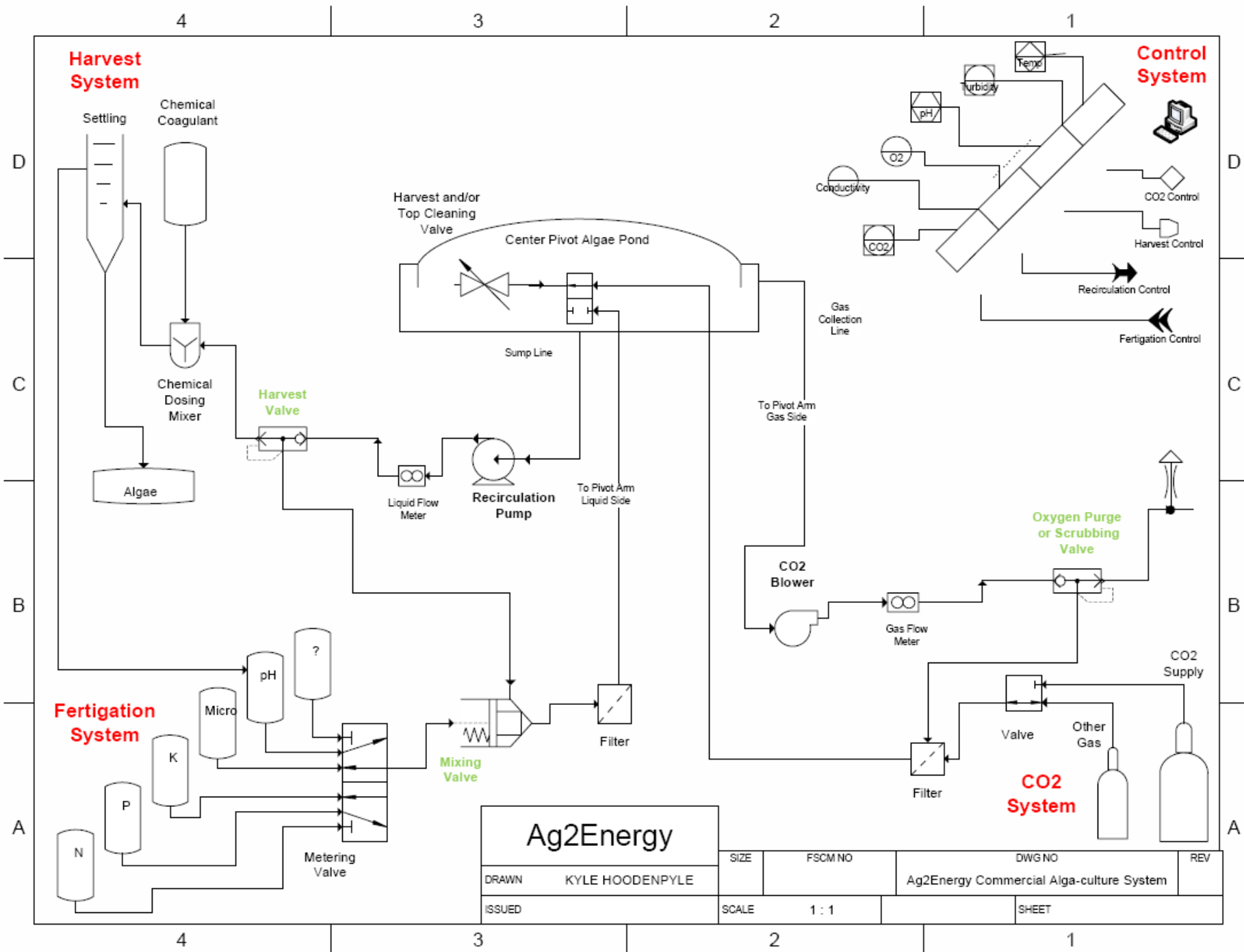
REV

SCALE

1 : 1

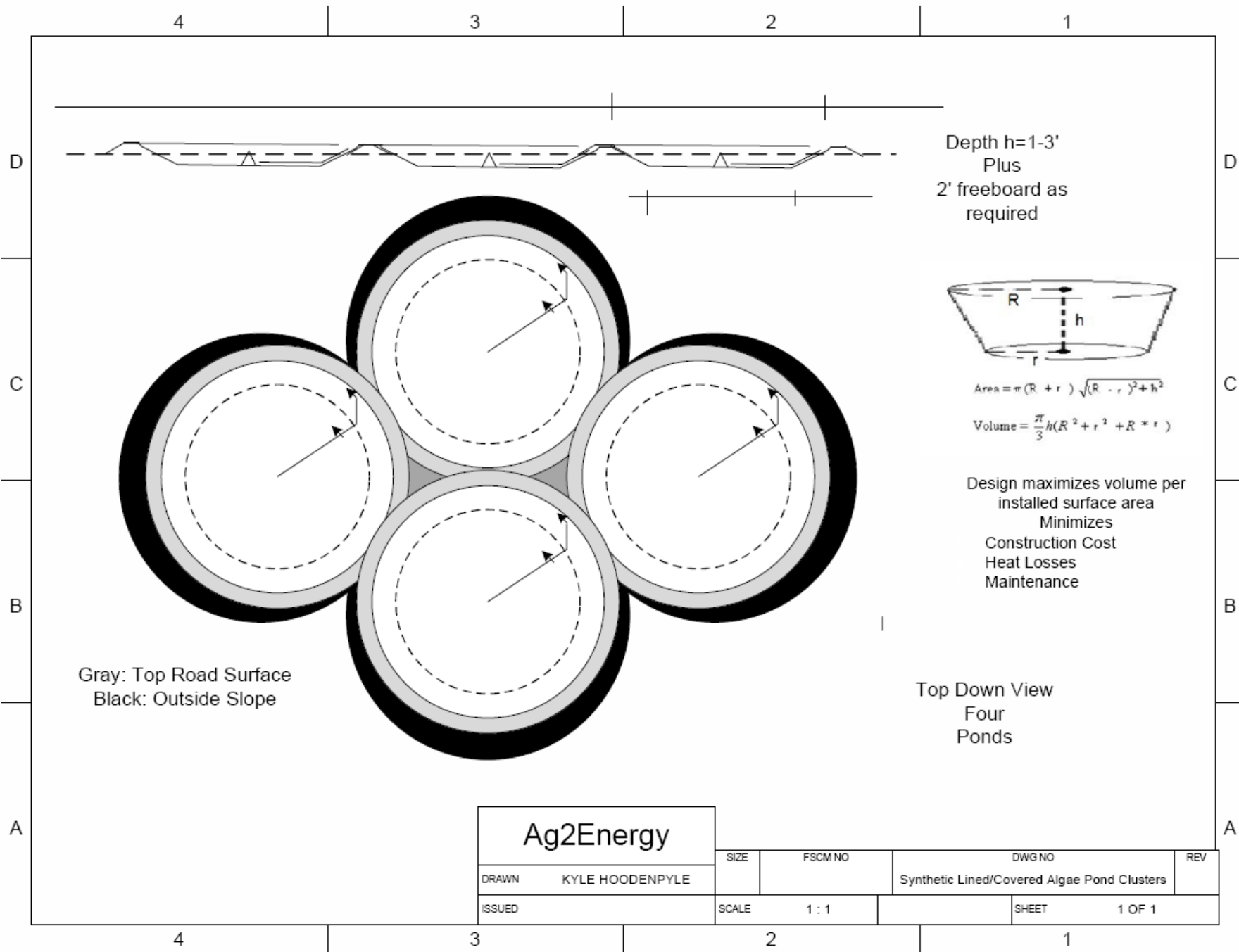
SHEET

1 OF 1



Ag2Energy	
DRAWN	KYLE HOODENPYLE
ISSUED	

SIZE	FSCM NO	DWG NO	REV
		Ag2Energy Commercial Alga-culture System	
SCALE	1 : 1	SHEET	



Synthetic Lined Ponds

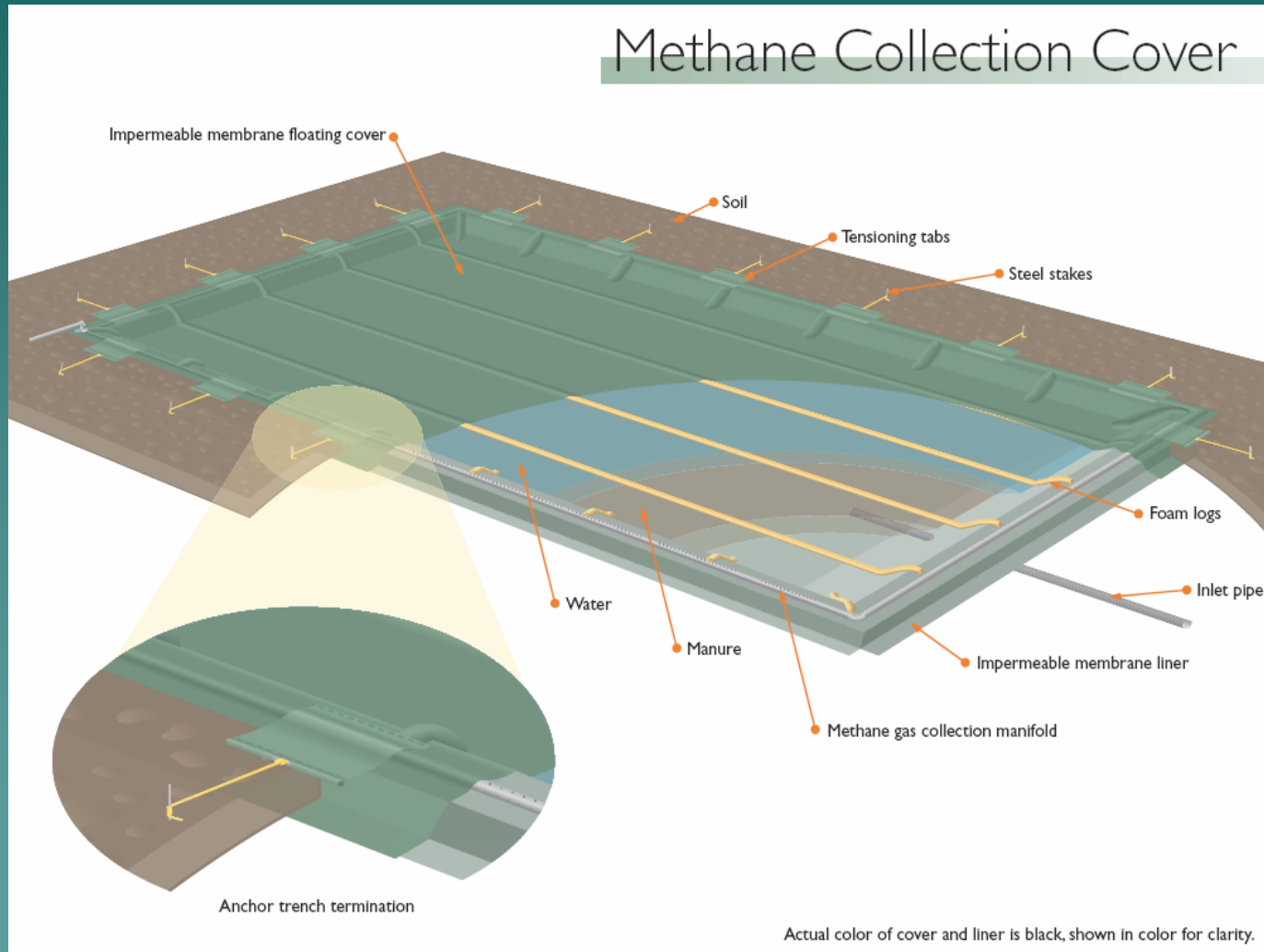
Proven Construction

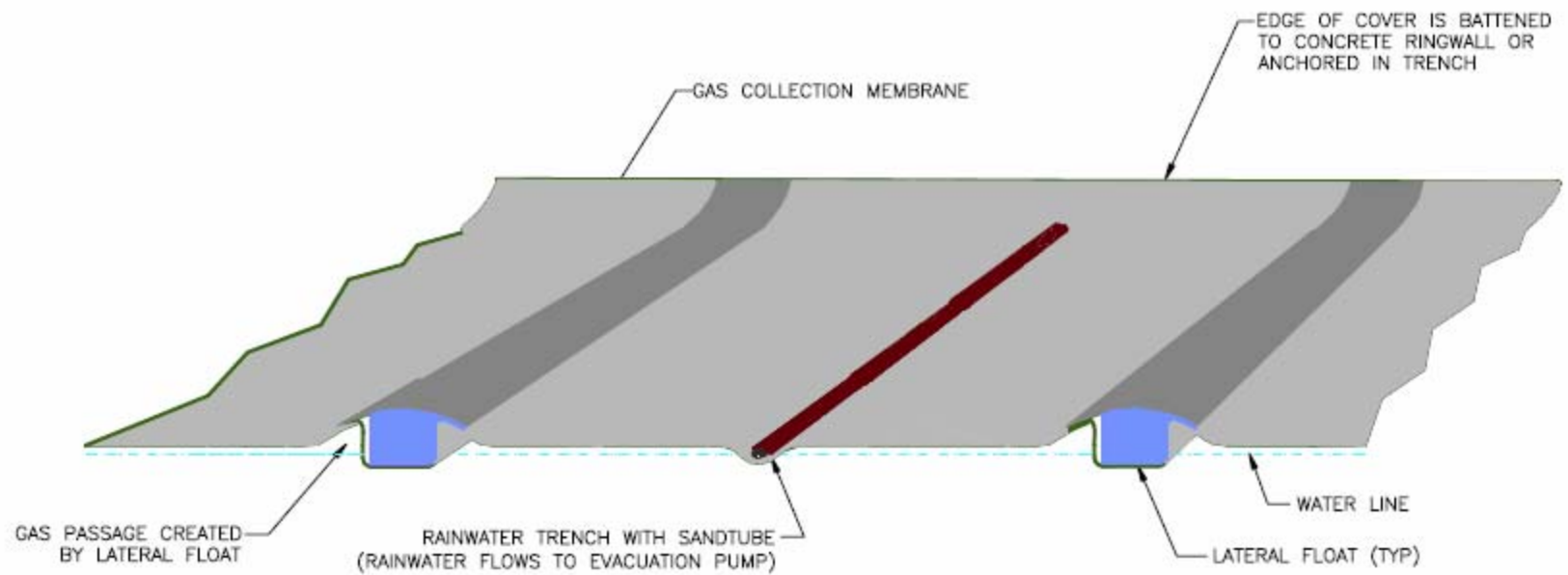


Perimeter Gas Collection



Algae pond is very similar to Proven gas collection systems on waste water treatment systems





Ag2Energy (ACAS) Photobioreactor Algae pond Demonstration

Arm mechanics

Drag

Flotation

Jet Mixing



Ag2Energy (ACAS) Photobioreactor Algae pond Demonstration

Jet driven distribution arm

Travel up to 2 ft/sec



Ag2Energy (ACAS) Photobioreactor Algae pond Demonstration

Jet injection of air simulates CO₂ and nutrients



Transparent cover can be stationary or rotate

Self cleaning with jet blasts

Solids concentrate in center

Assisted cleaning
with rotating
squeegee/brush



Materials Example: Strong geotextiles available for pond covers

UV resistant

5+ year warranties



Ag2Energy (ACAS) Photobioreactor Algae pond

Low environmental and visual impact: Ground Level Covered Ponds can be placed virtually anywhere

Imagine a transparent cover with internal gas collection passages



Ag2Energy Contact

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Texas & New Mexico
Dairy Industry Specialists

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